

DISTRIBUTION AND INCIDENCE OF LASPEYRESIA SPP. SEEDWORM INFESTATION
IN VIRGINIA, LOBLOLLY AND SHORTLEAF PINE CONES
IN THE SOUTHERN STATES

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In studies of the effects of insects on seed crops of southern pines one of the most difficult tasks is determining whether or not a specific insect, or insect group, is truly important. To date extensive surveys to evaluate relative importance of the various known insect pests of "flowers" and cones have been impractical both in terms of manpower available and of sampling procedures. Widespread reports of obvious damage or prevalence of certain insect species, such as *Dioryettia* spp. coneworm damage or seed bug, **Leptogto4s144** and **Tayra**, adults have served to justify research efforts. Less noticeable insects present a greater problem. One such group is the seedworms, **La4peyre4ia** spp. Most of you are undoubtedly aware of the seed damage caused by the larvae of these small moths. However, neither the moths nor their larval seed destruction are readily observed. The larvae do, nevertheless, remain overwinter in the axes of open second-year cones. This habit provides one an opportunity for sampling from a single easily-recognized host over an ample time period of about 6 months (October-March).

Since relatively little was known of either the distribution or prevalence of seedworms in loblolly, shortleaf and Virginia pines we decided that a south-wide study of the **LadspeotAia** infestations of these pine species would be both worthwhile and practical. To this end we enlisted the cooperation of federal, state and private industry personnel over a two-year period -- 1967-1968.

PROCEDURES

Cooperators were provided with simple data sheets to accompany cone collections. These provided records of collection location and such information as stand age and composition. Each cooperator was asked to provide 150 cones of each of the three pine species as available. Precise collection methods were left to the discretion of the collector. Cones were sent by various commercial transportation since during the overwinter period there was little hazard of insect mortality such as often occurs among insects shipped during warm weather.

Upon receipt of each collection a 20-cone sample was removed. The cones in this pre-rearing sample were dissected to detect the presence of **Laspeyresia** spp. infestation and the extent of such infestation in terms of numbers of cones infested, number of larvae per cone and number of seed destroyed per larva. The remaining cones of each collection were placed in chicken-wire or hardware-cloth "envelopes" and overwintered outdoors under a shortleaf pine canopy. Before anticipated moth emergence the cones were brought into an insectary and caged in suitably-sized cardboard boxes and lard cans fitted with glass

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collection jars. Emerging moths and parasites were attracted to the light through the jars hence readily collected. During the moth emergence period, late April-June, moths, and parasites, were collected daily from the jars. After emergence ceased all lots of cones which showed insect presence in the pre-rearing samples and/or from which moths emerged were held for another year because certain *Laspeyresia* spp. are known to diapause as larvae. The cones were again overwintered outdoors.

RESULTS -- DISCUSSION

Cooperation in this study proved to be very effective. in all 115 usable collections of 1967 crop cones were provided and 94 of 1968 cones. Of these, 90 were of loblolly pine, 73 of shortleaf pine and 46 of Virginia pine. Pre-rearing samples indicated that of 1967 loblolly collections 75 percent contained infested cones, and in 1968 87 percent were infested. Similarly collection infestation was 33 percent in 1967 and 26.5 percent in 1968 for shortleaf and 29 percent in 1967 and 32 percent in 1968 for Virginia pine cones.

Infestation in terms of the number of larvae per infested cone averaged 1.5 per loblolly cone, 1.4 per shortleaf cone, and 1.5 per Virginia pine cone in 1967. In 1968 cone collections about the same per cone infestation rate occurred, 1.75, 1.3 and 1.1 larva per cone for loblolly, shortleaf and Virginia pine respectively. From the data just presented one might consider that loblolly pine cones were heavily infested, and that control measures for *Laspeyresia* spp. might be warranted. However, it merely demonstrates the widespread occurrence of seedworms in loblolly pine as compared to the other two pine species. We need to consider the infestation rate on the basis of overall percentage of infested cones and the extent of seed destruction within cones before drawing conclusions. Loblolly pine was found to be again much more frequently infested than shortleaf or Virginia pines. For loblolly pine in 1967 the overall percentage of cones infested was 17 and in 1968 it was 17.5 percent. This contrasts with a very light infestation rate of 2.1 and 2.4 percent for shortleaf cones, and 5.4 and 2.7 percent for Virginia pine cones for 1967 and 1968 respectively. As we have already seen the average number of larvae per infested cone was similar for all three species ranging from about 1-2 larvae per cone.

Let us now look at the number of seed destroyed by each larva. Another convenient factor in *Laspeyresia* seed damage is the fact that infested seed tends to adhere within the open cones rather than to drop out. Counts of such seed were made from which we arrived at estimates of the number of seed destroyed per matured larva found. For loblolly pine this estimate was 6.2 seed per larva. The average for shortleaf pine was also 6.2 and for Virginia pine 7.4 seed destroyed per larva. These figures compare quite well with a 5-7 seed per larva figure reported by Merkel (1967) for *L. anaranjada* Miller in slash pine. Coyne (1968) reported an average of 4 longleaf pine seed destroyed by each *L. ingens* Heinr. but on a small sample (23 cones) he attributed 10-15 slash pine seed per larva for the same insect. Kraft (1968) reported an average of about 10 jack pine seed per larva for *L. toreuta* (Grote). In view of these estimates our figures seem somewhat conservative.

If we now apply our estimates of per cone infestation and per larva seed loss, we can arrive at a calculation of the total seed loss, for example, of the 1968 loblolly crop, based on our sampling. First, we had an overall cone infestation rate of 17.5 percent; second, we found an average of 1.75 larvae per infested cone which ate 6.2 seed per larva. If we consider 40-50 seed as a reasonable average of filled seed per cone as reported by Wakeley (1954) we can readily calculate the effect of seedworms on the 1968 loblolly seed crop as represented by our collections. To simplify, let me use 50 seed per cone as the expected average number of filled seed. First let us consider a sample of 1,000 cones. Of these we predicted 17.5 percent to be infested. Hence 175 cones would be subject to seed injury. Using the figures 1.75 (larvae per cone) x 6.2 (seed per larva) x 175 (infested cones expected) I arrive at a figure of 1,899 seed destroyed by *Laspeyresia*. Anticipated seed yield for 1,000 cones would be 50 x 1,000 = 50,000 seed. Dividing we find the estimated seed loss from *Laspeyresia* spp. to be 3.8 percent of total seed yield. The figures for 1967 loblolly collections would obviously be in a similar range since overall averages were similar. It would be questionable, I believe, that a 3.8 percent seed gain would be considered sufficient to justify routine control efforts, even in seed orchards. It would, however, be logical for a seed orchardist to check local trends in seedworm populations by sampling cones following seed harvest. Obviously the risk of seed loss of shortleaf or Virginia pine to *Laspeyresia*, based on our data, should be considerably less. It seems hardly worth consideration.

Before concluding I would like to add a few comments on the species of seedworms we reared, and on the extent of diapause as it occurred in our rearings. First, overall, the most prevalent species was *Laspeyresia toreuta*. Of over 500 reared specimens identified by Dr. D. R. Davis of the U. S. National Museum about 4/5 were this species. With rare exceptions the moths reared from Virginia and shortleaf pine were this species. On loblolly pine, however, *Laspeyresia ingens* also occurred, in about a 1:3 overall ratio, with *L. toreuta*. No obvious pattern seemed to exist in its occurrence, such as the presence of other host pines in the collection areas.

In rearing from both 1967 and 1968 collections about 20-25 percent of the *Laspeyresia* spp., and of a parasite, *Phanerotoma fasciata* Provancher, emerged the second summer following cone collection, indicating that under our rearing conditions diapause was prevalent. Such diapause has been reported previously for both *L. ingens*, Coyne (1968) and *L. toreuta*, Kraft (1968) but to a lesser extent.

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